Closed-Chest Drainage

Water seal or one way valve:
- The middle chamber is typically for the water seal
- Allows air to exit the pleural space and keeps air from entering pleural or mediastinal space on inspiration
- Fill water seal chamber with sterile fluid
- Keep drainage system upright at all times
- Maintain fluid at accurate level
- Tidaling: water in chamber rises with inhalation and returns to baseline with exhalation
- Continuous bubbling = air leak
- If positive pressure inhalation, fluid levels fall with inhalation and rise with exhalation
- Only release pressure with button when necessary b/c it can cause pneumothorax
- One way valve that replaces traditional water seal: maintains seal even if tipped over

Dry suction control:
- Allow for suction at higher pressure levels
- No need to replace fluid
- Quieter since no bubbling
- Self compensating regulator (automatic control valve) continuously balances the force of suction with atmosphere
- Adjust the section source until the float ball appears in the suction control indicator window

Heimlich valve: one way flutter valve allows air to escape but keeps it from re-entering the chest cavity; this accommodates a small or partial pneumothorax and does not collect fluid; arrow should always point away from client; inner valve should move during exhalation

Wet suction control
- Typically the fluid is filled to 20cm for adults
- Clients with fragile lung tissue, infants, and children may need lower levels
- Connect the suction source to the suction-control chamber and adjust the amt of suction to create gentle bubbling
- Water level determines amt of suction, not the settings on suction source

Pneumostat: one way valve attaches directly to chest tube to collect fluid (aka mobile chest drain) useful for clients who have pneumothorax and small amt of fluid

Conditions that effect oxygenation
Hemothorax- blood collection in pleural space (usually from chest trauma)
Chylothorax- leakage of lymph fluid from the thoracic duct into pleural cavity (severe heart failure, liver cirrhosis, pulmonary malignancies)
Empyema- pus in pleural space d/t infection, lung abscess, or infected pleural effusion
Pneumothorax- air collecting in the pleural space that causes a loss of negative intrapleural pressure resulting in partially or complete collapsed lung
Tension Pneumothorax- injury to chest wall or lungs allow air to enter pleural space but keeps it from escaping **medical emergency** venous return to the heart is impaired, hypotension and distended neck veins; mediastinal shift displaces trachea toward unaffected side
Mediastinal shift- shift of the thoracic mediastinum to one side
Crepitus: air leakage in subcutaneous tissue

Purpose of closed chest drainage:
Removes air and fluid from pleural space, prevents it from re-entering, and re-establishes the intrapleural and intrapulmonic pressures
Helps manage pleural or thoracic fluid after surgery, such as extensive cardiovascular surgery or a thoracotomy
Mediastinal chest tube under sternum drains blood and fluid from the pericardial sac to prevent cardiac tamponade: check for blood clots

Nursing Considerations

- Diminished or absent lung sounds: lung hasn't re-expanded
- Assess pain and provide analgesia
- Check chest tube dressing every 4 hours
- Palpate area surrounding the dressing for crepitus or subcutaneous emphysema- indicates air is leaking into tissue surrounding insertion site
- If drainage, note how much and monitor for more
- Use surgical asepsis to change dressing (sterile technique)
- Note character, consistency, and amt of drainage in the collection chamber at regular intervals (every hour during 1st 24 hrs
- Note time and date of drainage with tape on outside of container
- Assess fluid level of water seal chamber every shift since water can evaporate
- Assess for tidaling
- Fluctuation stops when lung has re-expanded

- Continuous bubbling in the water seal chamber indicates an air leak
- Observe for air leak- may mean accidental dislocation of the chest tube at insertion site
- Tape the tubing connection sites
- Keep sterile gauze at the bedside to cover insertion if tubing becomes dislodged
- Notify provider of continuous bubbling
- If prescribed apply rubber tipped forceps clamps on drainage tubing near occlusive dressing to determine if bubbling ceases
- If bubbling stops, air leak may be at the chest tube insertion site and need provider intervention

Dry suction control:

- Periodically check that air vent system is working properly and is not wet or blocked
- Coil the system's tubing, or lay it horizontally across the chair or bed before it drops vertically into the collection chamber
- Secure it to avoid dislodgment
- Be sure tubing remains below insertion site
- Avoid dependent loops, kinks, or pressure on the tubing
- Avoid lifting drainage system above client's chest because fluid could flow back into pleural space
- Do not strip or milk the tubing

Client Education:

- Encourage coughing and deep breathing
- Sitting upright promotes lung expansion
- Splinting while coughing reduces pain
- Thoracotomy- splint arm of the affected side to decrease discomfort
- Encourage active or provide passive ROM exercises for client's arm on affected side
- Remind ambulatory clients to keep drainage system below chest level and don't disconnect tubing
- Stay within range of length of suction tubing, sometimes provider will allow disconnection briefly

Nursing considerations:

- Pre-procedure:
  - Verify consent form signed
  - Fill water seal chamber
  - Admin pain meds
  - Prep insertion site with iodine
- Intra-procedure:
  - Help apply dressing on insertion site
  - Set up drainage system
  - Place system below client's chest level with tubing on bed above the system
  - Continually monitor vitals
- Post-procedure:
  - Assess vitals and respiratory assess every 4 hours
  - Encourage coughing and deep breathing every 2 hrs
  - Check water seal level every 2 hrs
  - Document amt and color of drainage hourly for 1st 24 hrs, then every 8 hrs
  - Excessive drainage > 70 mL/hr
  - Tape all connections
  - Place client in semi-high fowlers
  - Keep two enclosed hemostats, sterile water and occlusive dressing at bedside at all times
  - Notify pcp if SaO_2 <90%, if eyelets of tube become visible, drainage is excessive, drainage stops in first 24 hrs

Client Presentation:

- Dyspnea
- Distended neck veins
- Hemodynamic instability
- Pleuritic chest pain
- Cough
- Absent or reduced breath sounds on affected side
- Hyper resonance on percussion of affected side (pneumothorax)
- Dullness on percussion of affected side (hemothorax, pleural effusion,)
- Asymmetrical chest wall motion

Tube removal:

- Pain meds 30 mins before removal
- Assist provider with sutures and chest tube removal
- Client should use valsalva maneuver (reduces risk of air emboli)
- apply airtight sterile petroleum jelly gauze dressing; secure in place with stretch tape
- Chest x-ray verifies resolution of pneumothorax, hemothorax, or pleural effusion
- Monitor for excessive wound drainage, findings of infection, or recurrent pneumothorax.

Complications:

- Air leaks
  - Connection is not taped securely
  - Monitor for continuous bubbling
    - Tighten connection or replace drainage system
  - Notify provider if air leak is noted
- Accidental disconnection, system breakage, or removal
  - If tubing separates instruct client to exhale as much as possible, cough to remove as much air as possible from pleural space
  - Put end of disconnected chest tube in sterile water to provide temp water seal
  - If chest tube is accidentally removed dress area with dry sterile gauze- occlusive dressing
- Tension pneumothorax
  - Sucking chest wounds, prolonged clamping of tubing, mechanical ventilation with high levels of positive end expiratory pressure
  - Assessment findings: tracheal deviation, absent breath sounds to one side, distended neck veins, resp distress, asymmetry of the chest, cyanosis
  - RAPID RESPONSE